A Hybrid GERMcode-HZETRN Model for Studying Light Particle Transport Physics

Myung-Hee Y. Kim[1], Artem L. Ponomarev[1], Francis A. Cucinotta[2]
[1]USRA Division of Life Sciences, Houston TX 77058, USA
[2]NASA Lyndon B. Johnson Space Center, Houston TX 77058, USA

Abstract:

The high charge (Z) and energy (E) transport code (HZETRN) has proven to have good accuracy for radiation shielding calculations. For describing new risk assessment models based on the stochastics of particle tracks, we have developed the GCR event based risk model code (GERMcode), which allows for a rapid description of the stochastics of particle transport by using a simple forward-backward transport algorithm. In this approach, shielding calculations for complex spacecraft can be performed using ray-tracing methods by the GERMcode in an identical manner as HZETRN. Two approximations of the HZETRN code that we considered are the neglect of conservation of energy in nuclear fragmentation or cascade reactions, and the use of an average multiplicity in describing reactions rather than a distribution of particle multiplicities. In this report, we describe the development of a hybrid approach where HZETRN is used for HZE particles (A>4), which have multiplicities of 0 or 1, and GERMcode for light particles, including pions which often are produced in large multiplicity events. An evaluation of the importance of neglecting conservation of energy and multiplicity distributions is presented. Further considerations of the importance of event generators which couple the light and heavy particle production events in describing energy conservation and multiplicities are discussed.